TABLES

Table 1. Registered Well Information

Registered Owner	Use	Total Depth (Ft)	Static Water Level (Ft)
Sec 5, Township 14 N, Range 19 E			
Big Springs * Lehman Spring	Public	0	0
Big Spring Fish Hatchery	Monitoring (4)	10.4 - 37.3	NA
City of Lewistown - Big Springs	Public	0	0
Comes Dean and Julie	Domestic	300	180
Gill Dan	Domestic	160	67
MT Dept of Hwys * Big Spring North #1	Geotech	45.2	10.6
MT Dept of Hwys * Big Spring North #2	Geotech	35.7	11.3
Sec 31, Township 15 N, Range 19 E			
Chansen Fred	Domestic	60	0
Sec 32, Township 15 N, Range 19 E			
Bradley Ed and Linda	Domestic	185	83
Haugen Family Trust	Domestic	200	64
Hangen Family Trust	Domestic	400	265
Manuel Ted	Domestic	125	60
Patterson Grant	Domestic	90	60

NA - Not Available

Table 2. Comparison of 95% UCLs of PCB Concentrations in Stream Sediment for Herrera Data by Depth Interval

Depth Interval	PCB Concentration (µg/kg)	
	95% UCL	Recommended UCL Method
H1	12,970	95% Chebyshev(Mean, Sd)*
(Mean depth of 0 - 1 Inch, ranges from 0 to 3 Inches)	**13,006**	**95% KM (Chebyshev)***
	12,970	*95% Chebyshev(Mean, Sd)**
H2	993	95% Chebyshev(Mean, Sd)*
(Mean depth of 1 - 5 inches, ranges from 0.5 to 11 Inches)	**995.7**	**95% KM (Chebyshev)***
	990.4	*95% Chebyshev(Mean, Sd)**
H3	805.1	95% Chebyshev(Mean, Sd)*
(Mean depth of 5 - 9 inches, ranges from 2.5 to 17 Inches)	**808.8**	**95% KM (Chebyshev)***
	802.7	*95% Chebyshev(Mean, Sd)**
H4	146.6	95% Chebyshev(Mean, Sd)*
(Mean depth of 9 - 13 inches, ranges from 5 to 18.5 Inches)	**104.8**	**95% KM (t)**
	144.6	*95% Chebyshev(Mean, Sd)*

Method for handling nondetect values:

Regular - Lognormal Regression on Order Statistics (LnROS)

Bold - Nonparametric Kaplan-Meier (KM) Method

Italic - One-half of Detection Limit (DL/2). Not recommended by EPA and included for comparison only.

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

All PCB concentrations in µg/kg

Table 3. Comparison of 95% UCLs of PCB Concentrations in Stream Sediment for Herrera Data by Reach, Deposition Type, and Depth Interval

Depth	Reach 2 Deposition		Reach 2 Transport		Reach 3 Deposition		Reach 3 Transport		Reach 4 Deposition		Reach 4 Transport	
Interval	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method
H1	70,640	95% Chebyshev(Mean, Sd)*	4,068	95% Chebyshev(Mean, Sd)*	4,899	95% Chebyshev (MVUE)*	11,102	95% Chebyshev (MVUE)*	128.9	95% Chebyshev (MVUE)	322.2	95% Chebyshev(Mean, Sd)*
	71,024	**95% KM (Chebyshev)***	**2,248**	**95% KM (t)**	**8,173**	**95% KM (Chebyshev)***	**3,476**	**95% KM (BCA)**	**121.3**	**95% KM (t)**	**188.4**	**95% KM (t)**
	15,742	*95% Chebyshev (MVUE)**	*4,071*	*95% Chebyshev(Mean, Sd**	*4,905*	*95% Chebyshev (MVUE)**	*5,969*	*95% Chebyshev(Mean, Sd)**	*171.5*	*95% Chebyshev(Mean, Sd)*	*318.8*	*95% Chebyshev(Mean, Sd)*
H2	2,271	95% Chebyshev(Mean, Sd)*	4,356	95% Chebyshev(Mean, Sd)*	404.8	95% Approximate Gamma	283.5	95% Chebyshev (MVUE)	268.7	95% Chebyshev(Mean, Sd)*	47.5	95% Approximate Gamma
	2,281	**95% KM (Chebyshev)***	**4,474**	**95% KM (Chebyshev)***	**629.8**	**95% KM (Chebyshev)**	**249**	**95% KM (BCA)**	**172.8**	**95% KM (t)**	**50.09** **130**	**95% KM (t) or** **95% KM % Bootstrap)**
	2,270	*95% Chebyshev(Mean, Sd)**	*4,354*	*95% Chebyshev(Mean, Sd)**	*405.7*	*95% Approximate Gamma*	*410.4*	*95% Chebyshev(Mean, Sd)**	*258.4*	*95% Chebyshev(Mean, Sd)**	*37.58* *38.38*	*95% Student's-t UCL or* *95% Modified-t UCL*
H3	2,309	95% Chebyshev(Mean, Sd)*	334	95% Chebyshev (MVUE)*	3,329	95% Chebyshev(Mean, Sd)*	78.91	95% Chebyshev(Mean, Sd)	79.65	95% Chebyshev(Mean, Sd)	812.8 316.3 236.2	95% Hall's Bootstrap or 97.5% Chebyshev(Mean, Sd)** 95% Chebyshev(Mean, Sd)*
	1,363	**95% KM (BCA)**	**181** **250.5**	**95% KM (t) or** **95% KM % Bootstrap)**	**3,358**	**95% KM (Chebyshev)***	**57.27**	**95% KM (t)**	**60.34**	**95% KM (t)**	**179.4**	**95% KM (t)**
	2,309	*95% Chebyshev(Mean, Sd)**	*270.9*	*95% Chebyshev(Mean, Sd)**	*3,329*	*95% Chebyshev(Mean, Sd)**	*78.33*	*95% Chebyshev(Mean, Sd)*	*75.06*	*95% Chebyshev(Mean, Sd)*	*248.2*	*95% Chebyshev(Mean, Sd)*
H4	389.7	95% Chebyshev (MVUE)	53.21	95% Approximate Gamma	448.7	95% Chebyshev (MVUE)*	77.46	95% Approximate Gamma	30.99	95% Chebyshev (MVUE)*	112.1	95% Chebyshev (MVUE)
	299.4	**95% KM (BCA)**	**56.07** **69.92**	**95% KM (t) or** **95% KM % Bootstrap)**	**245.5** **278.2**	**95% KM (t) or** **95% KM % Bootstrap)**	**76.04** **230**	**95% KM (t) or** **95% KM (% Bootstrap)**	**59.17**	**95% KM (t)**	**189.7**	**95% KM (Chebyshev)***
	437.2	*95% Chebyshev(Mean, Sd)**	*72.2*	*95% Chebyshev(Mean, Sd)*	*365.5*	*95% Chebyshev(Mean, Sd)**	*114*	*95% Chebyshev(Mean, Sd)*	*39.24* *40.32*	*95% Student's-t or* *95% Modified-t UCL*	*148.3*	*95% Chebyshev(Mean, Sd)*

Method for handling nondetect values:

Regular - Lognormal Regression on Order Statistics (LnROS)

Bold - Nonparametric Kaplan-Meier (KM) Method

Italic - One-half of Detection Limit (DL/2). Not recommended by EPA and included for comparison only.

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

**97.5% or 99% Chebyshev (Mean, Sd) UCL recommended if Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value

All PCB concentrations in µg/kg

Table 4. Comparison of 95% UCLs of PCB Concentrations in Stream Sediment for Herrera Data by Reach and Depth Interval

Depth Interval	Reach 2		Reach 3		Reach 4	
	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method
H1	13,529	95% Chebyshev (MVUE)*	5,396	95% Chebyshev(Mean, Sd)*	208.5	95% Chebyshev(Mean, Sd)*
	36,087	**95% KM (Chebyshev)***	**5,411**	**95% KM (Chebyshev)***	**131.7**	**95% KM (t)**
	35,863	*95% Chebyshev(Mean, Sd**	*5,397*	*95% Chebyshev(Mean, Sd)**	*205.3*	*95% Chebyshev(Mean, Sd)*
H3	2,681	95% Chebyshev(Mean, Sd)*	317.4	95% H-UCL	154.7	95% Chebyshev(Mean, Sd)
	2,695	**95% KM (Chebyshev)***	**423.8**	**95% KM (Chebyshev)**	**108.8**	**95% KM (BCA)**
	2,678	*95% Chebyshev(Mean, Sd**	*421.2*	*95% Chebyshev(Mean, Sd)**	*151.4*	*95% Chebyshev(Mean, Sd)*
H3	546.2	95% Chebyshev (MVUE)	1,748	95% Chebyshev(Mean, Sd)*	151.1	95% Chebyshev(Mean, Sd)
	681.8	**95% KM (t)**	**1,758**	**95% KM (Chebyshev)***	**98.76** **103.4**	**95% KM (t) or** **95% KM (% Bootstrap)**
H4	167.5	95% H-UCL	157.3	95% H-UCL	51.55	95% H-UCL
	169.6	**95% KM (t)**	**141.9**	**95% KM (t)**	**63.26** **162.4**	**95% KM (t) or** **95% KM (% Bootstrap)**
	263.2	*95% Chebyshev(Mean, Sd)**	*222.4*	*95% Chebyshev(Mean, Sd)**	*86.46*	*95% Chebyshev(Mean, Sd)*

Method for handling nondetect values:

Regular - Lognormal Regression on Order Statistics (LnROS)

Bold - Nonparametric Kaplan-Meier (KM) Method

Italic - One-half of Detection Limit (DL/2). Not recommended by EPA and included for comparison only.

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

All PCB concentrations in µg/kg

Table 5. Comparison of 95% UCLs of PCB Concentrations in Stream Sediment for Herrera Data by Subeach and Depth Interval

Depth	Subreach 2A		Subreach 2B		Subreach 3a		Subreach 3B		Subreach 4A		Subreach 4B	
Interval	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method
H1	90,050	95% Chebyshev (MVUE)*	378.6	95% Adjusted Gamma	12,203	95% Chebyshev (MVUE)*	321.9	95% Approximate Gamma	132.7	95% Chebyshev(Mean, Sd)	461.2	95% Chebyshev(Mean, Sd)*
	79,532	**95% KM (Chebyshev)***	**310.3** **332.3**	**95% KM (t) or** **95% KM (% Bootstrap)**	**7,995**	**95% KM (Chebyshev)***	**253.6** **257.6**	**95% KM (t) or** **95% KM (% Bootstrap)**	**95.2**	**95% KM (t)**	**267.8**	**95% KM (t)**
	79,159	*95% Chebyshev(Mean, Sd)**	*446*	*95% Chebyshev(Mean, Sd)**	*10,758*	*95% Chebyshev (MVUE)**	*396.9*	*95% Chebyshev(Mean, Sd)**	*133.2*	*95% Chebyshev(Mean, Sd)*	*453.9*	*95% Chebyshev(Mean, Sd)**
H2	5,514	95% Chebyshev (MVUE)*	153.5	95% Chebyshev (MVUE)	382.2	95% Approximate Gamma	238.2	95% Chebyshev(Mean, Sd)	190.8	95% Chebyshev(Mean, Sd)*	172.8	95% Chebyshev(Mean, Sd)
	5,745	**95% KM (Chebyshev)***	**133.9**	**95% KM (t)**	**571.2**	**95% KM (Chebyshev)**	**152** **162.8**	**95% KM (t) or** **95% KM (% Bootstrap)**	**146**	**95% KM (BCA)**	**112.7** **164.3**	**95% KM (t) or** **95% KM (% Bootstrap)**
	5,018	*95% Chebyshev (MVUE)**	*209.5*	*95% Chebyshev(Mean, Sd)**	*521.3*	*95% H-UCL*	*235.6*	*95% Chebyshev(Mean, Sd)**	*190.7*	*95% Chebyshev(Mean, Sd)*	*165.9*	*95% Chebyshev(Mean, Sd)*
H3	414.5	95% Adjusted Gamma	2035	95% Chebyshev(Mean, Sd)*	2,492	95% Chebyshev(Mean, Sd)*	61.11	95% Approximate Gamma	215.6	95% Chebyshev(Mean, Sd)*	40.46	95% Student's-t
	318.6	**95% KM (BCA)**	**1111**	**95% KM (t)**	**2,515**	**95% KM (Chebyshev)***	**52.61** **51.92**	**95% KM (t) or** **95% KM (% Bootstrap)**	**138.4**	**95% KM (t)**	**30.8** **55**	**95% KM (t) or** **95% KM (% Bootstrap)**
	486.8	*95% Chebyshev(Mean, Sd)**	*2031*	*95% Chebyshev(Mean, Sd)**	*2,492*	*95% Chebyshev(Mean, Sd)**	*74.72*	*95% Chebyshev(Mean, Sd)*	*216.7*	*95% Chebyshev(Mean, Sd)*	*26.8* *27.21*	*95% Student's-t* *or 95% Modified-t*
H4	396	95% Chebyshev (MVUE)*	121.5	95% Chebyshev(Mean, Sd)	127.8	95% H-UCL	315.5	95% Chebyshev (MVUE)	20.74	95% Student's-t	148.7	95% H-UCL
	267.2	**95% KM (t)**	**79.16** **80.46**	**95% KM (t) or** **95% KM (% Bootstrap)**	**121.4**	**95% KM (t)**	**--**	**--**	**--**	**--**	**145.4** **379**	**95% KM (t) or** **95% KM (% Bootstrap)**
	429.6	*95% Chebyshev(Mean, Sd)**	*115.3*	*95% Chebyshev(Mean, Sd)*	*191.5*	*95% Chebyshev(Mean, Sd)*	*574*	*95% Chebyshev(Mean, Sd)**	*20.5* *20.54*	*95% Student's-t or* *95% Modified-t*	*209.8*	*95% Chebyshev(Mean, Sd)**

Method for handling nondetect values:

Regular - Lognormal Regression on Order Statistics (LnROS)

Bold - Nonparametric Kaplan-Meier (KM) Method

Italic - One-half of Detection Limit (DL/2). Not recommended by EPA and included for comparison only.

-- Not enough values above the detection limit in the subreach to complete the analysis

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

All PCB concentrations in µg/kg

Table 6. Mean PCB Concentrations in Stream Sediment for Herrera Data by Subreach and Depth Interval

Depth Interval	Mean PCB Concentration, µg/kg					
	Subreach 2A	Subreach 2B	Subreach 3A	Subreach 3B	Subreach 4A	Subreach 4B
H1	16,602	152.8	3,645	142.7	26.14	131.7
H2	1,685	56.21	223.3	92.10	87.97	66.48
H3	188.4	546.0	961.0	44.48	75.49	35.31
H4	146.7	52.01	74.39	146.1	15.29	81.65

Note: Nondetect values substituted with Lognormal Regression on Order Statistics (LnROS) values

Table 7. Sediment Removal Volume Calculations

Volume Scenario 1: Partial Removal - Reach 2 and 3, Depth Intervals H1, H2 and H3

	Reach 2		Reach 3		Reach 4		∑ Area
	Area, SF	146,352	Area, SF	264,217	Area, SF	228,563	639,132
Depth Interval	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Total (CY)
H1	1	450	1	820		0	1,270
H2	4	1,810	4	3,260		0	5,070
H3	4	1,810	4	3,260		0	5,070
H4		0		0		0	0
Depth	9		9		0		
Total (CY)		4,070		7,340		0	11,410

Volume Scenario 2: Partial Removal - Subreach 2A, 2B and 3A, Upper Six Inches

	Reach 2A		Reach 2B		Reach 3A		Reach 3B		Reach 4A		Reach 4B		∑ Area
	Area, SF	77,409	Area, SF	71,005	Area, SF	110,163	Area, SF	151,992	Area, SF	114,988	Area, SF	113,575	639,132
Depth Interval	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Total (CY)
6"	6	1,430	6	1,310	6	2,040		0		0		0	4,780
Depth	6		6		6		0		0		0		
Total (CY)		1,430		1,310		2,040		0		0		0	4,780

Table 7. Sediment Removal Volume Calculations, continued

Volume Scenario 3: Partial Removal by Subreach (where Depth Interval 95% UCL > 189 ug/kg) Based on Mean Depths

Depth Interval	Reach 2A		Reach 2B		Reach 3A		Reach 3B		Reach 4A		Reach 4B		∑ Area
	Area, SF	77,409	Area, SF	71,005	Area, SF	110,163	Area, SF	151,992	Area, SF	114,988	Area, SF	113,575	639,132
	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Total (CY)
H1	1	240	1	220	1	340	1	470		0	1	350	1,620
H2	4	960	3	660	3	1,020	5	2,350		0		0	4,990
H3	5	1,190	5	1,100	5	1,700	4	1,880		0		0	5,870
H4	6	1,430		0		0	4	1,880		0		0	3,310
Depth	16		9		9		14		0		1		
Total (CY)		3,820		1,980		3,060		6,580		0		350	15,790

Volume Scenario 4: Total Removal to 36 inches

Depth Interval	Reach 2A		Reach 2B		Reach 3A		Reach 3B		Reach 4A		Reach 4B		∑ Area
	Area, SF	77,409	Area, SF	71,005	Area, SF	110,163	Area, SF	151,992	Area, SF	114,988	Area, SF	113,575	639,132
	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Total (CY)
36"	36	8,600	36	7,890	36	12,240	36	16,890	36	12,780	36	12,620	71,020

Volume Scenario 5: Partial Removal - Subreach 2A, 2B, 3A, 3B, 4A, and 4B, Upper Six Inches

Depth Interval	Reach 2A		Reach 2B		Reach 3A		Reach 3B		Reach 4A		Reach 4B		∑ Area
	Area, SF	77,409	Area, SF	71,005	Area, SF	110,163	Area, SF	151,992	Area, SF	114,988	Area, SF	113,575	639,132
	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Thickness (Inches)	Volume (CY)	Total (CY)
6"	6	1,430	6	1,320	6	2,040	6	2,810	6	2,130	6	2,100	11,830
Depth	6		6		6		6		6		6		
Total (CY)		1,430		1,320		2,040		2,810		2,130		2,100	11,830

Table 8. Risk-Based Fish Tissue Concentrations Protective for a Range of Cancer Risks Based on Aroclors (Total PCBs)

Number of Fish Meals Per Month	Ingestion Rate (kg/day)	Aroclor (Total PCB) Tissue Concentration (mg/kg)		
		Cancer Risk of 10^{-4}	Cancer Risk of 10^{-5}	Cancer Risk of 10^{-6}
1	0.0075	1.20	1.20×10^{-1}	1.20×10^{-2}
2	0.015	5.99×10^{-1}	5.99×10^{-2}	5.99×10^{-3}
3	0.023	3.99×10^{-1}	3.99×10^{-2}	3.99×10^{-3}
4	0.030	3.00×10^{-1}	3.00×10^{-2}	3.00×10^{-3}
5	0.038	2.40×10^{-1}	2.40×10^{-2}	2.40×10^{-3}
6	0.045	2.00×10^{-1}	2.00×10^{-2}	2.00×10^{-3}
7	0.053	1.71×10^{-1}	1.71×10^{-2}	1.71×10^{-3}
8	0.060	1.50×10^{-1}	1.50×10^{-2}	1.50×10^{-3}
9	0.068	1.33×10^{-1}	1.33×10^{-2}	1.33×10^{-3}
10	0.075	1.20×10^{-1}	1.20×10^{-2}	1.20×10^{-3}
11	0.083	1.09×10^{-1}	1.09×10^{-2}	1.09×10^{-3}
12	0.090	9.99×10^{-2}	9.99×10^{-3}	9.99×10^{-4}

Source: CDM, 2009
Aroclor concentrations were estimated by multiplying TCDD TEQ concentrations by 35,764, the average ratio of Aroclor to TCDD TEQ concentrations in trout taken from Big Spring Creek, Area 3 (CDM, 2009)

Table 9. Meal Guidelines for Consumption of Fish Contaminated with PCBs (DPHHS)

	Below 0.025 mg/kg	**0.025 – 0.10 mg/kg**	**0.11 – 0.47 mg/kg**	**>0.47 mg/kg**
Meal Advice	Unlimited	1 meal/week	1 meal/month	Don’t eat

Table 10. Comparison of DPHHS Meal Guidelines and Projected Fish PCB Concentrations

Meal Advice	Fish Tissue PCB Conc (mg/kg)	Stream Sediment PCB Concentration (µg/kg)	
		Rainbow Trout	Brown Trout
Unlimited	0.025	<3	15
1 meal/week	0.1	40	22
1 meal/month	0.47	264	58

Table 11. Projected Sediment Concentrations to Achieve Risk-Based Fish Tissue Concentrations Protective for a Range of Cancer Risks

PCB Concentration (Aroclor 1254 in mg/kg) for Rainbow Trout and Stream Sediment

	Cancer Risk					
	1.00E-04		1.00E-05		1.00E-06	
Meals/Month	Fish Tissue	Sed Conc*	Fish Tissue	Sed Conc*	Fish Tissue	Sed Conc*
1	1.20E+00	0.707	1.20E-01	0.052	1.20E-02	<0.003
2	5.99E-01	0.342	5.99E-02	0.015	5.99E-03	<0.003
3	3.99E-01	0.221	3.99E-02	0.003	3.99E-03	<0.003
4	3.00E-01	0.161	3.00E-02	<0.003	3.00E-03	<0.003
5	2.40E-01	0.125	2.40E-02	<0.003	2.40E-03	<0.003
6	2.00E-01	0.100	2.00E-02	<0.003	2.00E-03	<0.003
7	1.71E-01	0.083	1.71E-02	<0.003	1.71E-03	<0.003
8	1.50E-01	0.070	1.50E-02	<0.003	1.50E-03	<0.003
9	1.33E-01	0.060	1.33E-02	<0.003	1.33E-03	<0.003
10	1.20E-01	0.052	1.20E-02	<0.003	1.20E-03	<0.003
11	1.09E-01	0.045	1.09E-02	-<0.003	1.09E-03	<0.003
12	9.99E-02	0.040	9.99E-03	<0.003	9.99E-04	<0.003

*Sediment PCB (Aroclor 1254) concentration calculated from fish tissue/sediment relationship for RBT

PCB Concentration (Aroclor 1254 in mg/kg) for Brown Trout and Stream Sediment

	Cancer Risk					
	1.00E-04		1.00E-05		1.00E-06	
Meals/Month	Fish Tissue	Sed Conc*	Fish Tissue	Sed Conc*	Fish Tissue	Sed Conc*
1	1.20E+00	0.130	1.20E-01	0.024	1.20E-02	0.014
2	5.99E-01	0.071	5.99E-02	0.018	5.99E-03	0.013
3	3.99E-01	0.052	3.99E-02	0.016	3.99E-03	0.013
4	3.00E-01	0.042	3.00E-02	0.015	3.00E-03	0.013
5	2.40E-01	0.036	2.40E-02	0.015	2.40E-03	0.013
6	2.00E-01	0.032	2.00E-02	0.014	2.00E-03	0.013
7	1.71E-01	0.029	1.71E-02	0.014	1.71E-03	0.013
8	1.50E-01	0.027	1.50E-02	0.014	1.50E-03	0.013
9	1.33E-01	0.026	1.33E-02	0.014	1.33E-03	0.013
10	1.20E-01	0.024	1.20E-02	0.014	1.20E-03	0.013
11	1.09E-01	0.023	1.09E-02	0.014	1.09E-03	0.013
12	9.99E-02	0.022	9.99E-03	0.013	9.99E-04	0.013

*Sediment PCB (Aroclor 1254) concentration calculated from fish tissue/sediment relationship for LL

Table 12. Treatment Technology Screening Matrix

Soil, Sediment, Bedrock and Sludge	Development Status	Treatment Train	O&M	Capital	System Reliability & Maintenance	Relative Costs	Time	Availability	Halogenated SVOCs (including PCBs)	Retained
3.1 In Situ Biological										
4.1 Bioventing	●	●	●	●	●	●	=	●	○	No
4.2 Enhanced Bioremediation	●	●	○	=	=	●	=	●	◊	No
4.3 Phytoremediation	●	●	●	●	○	●	○	=	◊	No
3.2 In Situ Physical/Chemical										
4.4 Chemical Oxidation	●	●	○	=	=	=	●	●	=	Yes
4.5 Electrokinetic separation	●	○	○	=	=	○	=	=	=	No
4.6 Fracturing	●	=	=	○	=	=	=	●	=	Yes
4.7 Soil Flushing	●	●	○	=	=	=	=	●	=	Yes
4.8 Soil Vapor Extraction	●	○	○	=	●	●	=	●	○	No
4.9 Solidification/Stabilization	●	●	=	○	●	●	●	●	=	Yes
3.3 In Situ Thermal										
4.10 Thermal Treatment	●	○	○	○	●	=	●	●	●	No
3.4 Ex Situ Biological										
4.11 Biopiles	●	●	●	●	●	●	=	●	◊	No
4.12 Composting	●	●	●	●	●	●	=	●	◊	No
4.13 Landfarming	●	●	●	●	●	●	=	●	=	Yes
4.14 Slurry Phase	●	○	○	○	=	=	=	●	◊	No

Table 12. Treatment Technology Screening Matrix (continued)

Soil, Sediment, Bedrock and Sludge	Development Status	Treatment Train	O&M	Capital	System Reliability & Maintenance	Relative Costs	Time	Availability	Halogenated SVOCs (including PCBs)	Retained
3.5 Ex Situ Physical/Chemical										
4.15 Chemical Extraction	●	○	○	○	=	=	=	●	●	No
4.16 Chemical RedOx	●	=	=	○	●	=	●	●	=	Yes
4.17 Dehalogenation	●	=	○	○	○	○	=	=	●	Yes
4.18 Separation	●	=	○	=	●	=	●	●	=	Yes
4.19 Soil Washing	●	○	○	○	●	=	●	●	=	No
4.20 Solidification/Stabilization	●	●	=	○	●	●	●	●	=	Yes
3.6 Ex Situ Thermal										
4.21 Hot Gas Decontamination	○	●	○	○	●	●	●	=	○	No
4.22 Incineration	●	●	○	○	=	○	●	●	●	Yes
4.23 Open Burn/Open Detonation	●	●	○	○	●	●	●	●	○	No
4.24 Pyrolosis	●	●	○	○	○	○	●	●	●	Yes
4.25 Thermal Desporption	●	●	○	○	=	=	●	●	●	Yes
3.7 Containment										
4.26 Landfill Cap	●	●	=	○	●	●	○	●	=	Yes
4.27 Landfill Cap Enhancements	●	●	=	○	●	●	○	●	=	Yes
3.9 Other Treatment										
4.28 Off-Site Disposal	●	●	●	●	●	◊	●	●	=	Yes

Table 12. Treatment Technology Screening Matrix (continued)

Legend

Factors			● Above Average	= Average	○ Below Average	◊ Other
Development Status Scale status of an available technology			Implemented as part of the final remedy at multiple sites, well documented, understood, etc.	Has been implemented at full scale but still needs improvements, testing, etc.	Not been fully implemented but has been tested (pilot, bench, lab scale) and is promising	Level of effective-ness highly dependent upon specific contaminant and its application & design
Treatment Train Is the technology only effective as part of the treatment train?			Stand-alone technology (not complex in terms of number of media & treatment technologies, maybe one "routine" technology in addition)	Relatively simple (two-car train or so), and well understood, widely applied, etc.	Complex (more technologies, media to be treated, generages excessive waste, etc.)	
Relative overall cost and performance	**O&M** Operation and Maintenance Intensive		Low degree of O&M intensity	Average degree of O&M intensity	High degree of O&M intensity	
	Capital Capital Intensive		Low degree of capital investment	Average degree of capital investment	High degree of capital investment	
	System Reliability/Maintainability The expected range of demonstrated reliability and maintenance relative to other effective technologies		Highly reliable and low maintenance	Average reliability and average maintenance	Low reliability and high maintenance	
	Relative Costs Design, construction, and operations and maintenance (O&M) costs of the core process that defines each and pre-post treatment		Low degree of general costs relative to other options	Average degree of general costs relative to other options	High degree of general costs relative to other options	
	Time Time required to clean up a technology	in situ soil	Less than 1 year	1-3 years	More than 3 years for in situ soil	
		ex situ soil	Less than 0.5 year	0.5-1 year	More than 1 year for ex situ soil	
		groundwater	Less than 3 years	3-10 years	More than 10 years for water	
Availability Number of vendors that can design, construct, and maintain the technology			More than 4 vendors	2-4 vendors	Fewer than 2 vendors	
Contaminants Treated Halogenated SVOCs			Effectiveness Demonstrated at Pilot or Full Pilot of Full Scale	Limited Effectiveness Demon-strated at Pilot or Full Scale	No Demonstrated Effectiveness at Pilot or Full Scale	

Table 13. Screening of Potential Remediation Technologies and Process Options

General Response Action	Remediation Technology	Process Option	Description	Initial Screening: Implementability	Initial Screening: Screening Decision	Final Screening: Effectiveness	Final Screening: Cost	Final Screening: Screening Decision
No Action	None	Not applicable	No action involves deferral of remedial action.	Potentially applicable	Retained	Not effective, but retained as suggested by NCP.	Low	Retained
Monitored Natural Recovery	Physical Degradation, Biological Degradation, Physical Burial	Combination of Desorption, Diffusion, Dilution, Volatilization, Resuspension, and Transport	Monitored Natural Recovery refers to the reduction of volume and toxicity of contaminants in sediments by naturally occurring biological, chemical, or physical processes. Extensive site monitoring and modeling are conducted to document contaminant reduction.	Technically implementable and potentially applicable. Could be combined with removal or containment general response action for portions of the site.	Retained	May be effective for portions of Big Spring Creek or in conjunction with "hot spot" removal of contaminated sediment.	Low	Retained
Institutional Controls	Administrative Restrictions	Fish Consumption Restrictions, Deed Restrictions, Declaration of Restrictive Covenants, Controlled Ground Water Area	Institutional controls include site access and/or use restrictions. Restrictions can include fish consumption restrictions or deed restrictions to limit site use.	Technically implementable, but difficult to enforce.	Retained	Provides limited protection as a stand alone option, but may be effective in conjunction with other process options such as Monitored Natural Recovery. A Preliminary Remedial Action Objective to remove the existing fish consumption restriction would not be met with this option.	Low	Retained
Containment	Capping	In-Situ Capping	In-situ capping refers to the placement of a subaqueous covering or cap of clean material over contaminated sediment that remains in place. Caps are generally constructed of granular material, such as clean sediment, sand, or gravel. A more complex cap design can include geotextiles, liners, and other permeable or impermeable elements in multiple layers that may include additions of material to attenuate the flux of contaminants (e.g., organic carbon). Capping is sometimes considered following partial sediment removal where capping alone is not feasible due to a need to preserve a minimum water body depth for navigation or flood control, or where it is desirable to leave deeper contaminated sediment in place to preserve bank or shoreline stability following removal.	Technically implementable. In-situ capping is better suited for deep-water or low-energy flow environments. Provides limited protection as a stand alone option, but may be effective in conjunction with partial removal of contaminated sediment and monitored natural recovery.	Retained	Not effective as a stand-alone option, but may be effective in conjunction with partial removal of contaminated sediment and/or monitored natural recovery.	Medium	Retained
In-Situ Treatment	Biological	Enhanced Microbial Degradation	Enhancement of microbial degradation of contaminants by the additon of materials such as oxygen, nitrate, sulfate, hydrogen, nutrients, substrate (e.e., organic carbon), or microorganisms into the sediment or into a reactive cap.	In the early stages of development and few methods ar currently commercially available. Development of an effective in-situ delivery system to add and mix needed levels of reagents to contaminated sediment has been problematic. Limited full-scale applications.	Eliminated			
	Chemical	Chemical Oxidation	Oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.	Requires in-water steel piling around treatment area and extensive water quality monitoring outside piles. Limited full-scale applications.	Eliminated			

Table 13. Screening of Potential Remediation Technologies, continued

General Response Action	Remediation Technology	Process Option	Description	Initial Screening: Implementability	Initial Screening: Screening Decision	Final Screening: Effectiveness	Final Screening: Cost	Final Screening: Screening Decision
In-Situ Treatment	Chemical	Fracturing	Cracks are developed by fracturing beneath the surface in low permeability and over-consolidated sediments to open new passageways that increase the effectiveness of many in-situ processes and enhance extraction efficiencies	Fractures will close in non-clayey soils. Not a stand-alone technology. Requires additional treatment. The potential exists to open new pathways for the unwanted spread of contaminants. Limited potential for in-stream applications	Eliminated			
		Soil Flushing	Water, or water containing an additive to enhance contaminant solubility, is applied to the soil or injected into the ground water to raise the water table into the contaminated soil zone. Contaminants are leached into the ground water, which is then extracted and treated.	Requires in-water steel piling around treatment area and extensive water quality monitoring outside piles. Potential to leach and spread contaminants. Limited known full-scale applications.	Eliminated			
		Solidification/Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	Target contaminants are typically inorganics. Has been tested on PCBs. Some processes result in a significant increase in volume (up to double the original volume). The solidified material may hinder future site use.	Eliminated			
Removal	Dredging	Mechanical Dredging	A mechanical dredge consists of a crane that maneuvers a cable-suspended dredging bucket. The bucket is lowered into the sediment, and when withdrawn the cable closes the jaws of the bucket, retaining dredged material.	Technically implementable. Requires measures to control discharge of sediment during dredging. Requires staging areas for storage and dewatering of sediment prior to treatment or disposal.	Retained	Potential to discharge sediment to Big Spring Creek during dredging. Sediment will require dewatering prior to treatment or disposal.	Medium	Retained
		Hydraulic Dredging	Removes and transports sediment in the form of a slurry through the addition of high voumes of water. The excess water is discharged as effluent at a treatment or disposal site and often needs treatment prior to discharge. Hydraulic dredges may be equipped with rotating blades, augers or high-pressure water jets to loosen the sediment.	Technically implementable. Requires measures to control discharge of sediment during dredging. Requires staging areas for storage and dewatering of sediment prior to treatment or disposal. Can allow for limited depth removal or to pinpoint "hot spots".	Retained	Potentially effective. Would remove impacted materials from Big Spring Creek corridor. Sediment will require dewatering prior to treatment or disposal.	Medium	Retained
	Dry Excavation	Excavator	This removal option includes constructing a diversion channel or pumping the stream to bypass excavation areas to allow excavation of contaminated sediment in a dewatered environment.	Removal involves conventional excavation equipment after stream is dewatered. Requires staging areas for heavy equipment and construction of access roads.	Retained	Dry excavation would remove the impacted materials from the Big Spring Creek corridor. Would require the use of a temporary diversion channel or pumping system large enough to accommodate flow of Big Spring Creek.	Medium	Retained
Ex-Situ Treatment	Biological	Landfarming	Contaminated soil, sediment, or sludge is excavated, applied into lined beds, and periodically turned over or tilled to aerate the waste.	Ex-situ landfarming has been proven most successful in treating petroleum hydrocarbons. As a rule of thumb, the higher the molecular weight , the slower the degradation rate. Also, the more chlorinated the compound, the more difficult it is to degrade. Requires a large land area.	Eliminated			

Table 13. Screening of Potential Remediation Technologies and Process Options, continued

General Response Action	Remediation Technology	Process Option	Description	Initial Screening: Implementability	Initial Screening: Screening Decision	Final Screening: Effectiveness	Final Screening: Cost	Final Screening: Screening Decision
Ex-Situ Treatment	Chemical	Chemical RedOx	Reduction/oxidation chemically converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide, hypochlorites, chlorine, and chlorine dioxide.	The target contaminant group for chemical RedOx is inorganics. The technology is less effective for SVOCs and hydrocarbons. Incomplete oxidation or formation of intermediate contaminants may occur depending upon the contaminants and oxidizing agents used. Not cost-effective for high contaminant concentrations because of large amounts of oxidizing agent required.	Eliminated			
		Dehalogenation	Reagents are added to soils contaminated with halogenated organics. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants.	The target contaminant groups for dehalogenation treatment are halogenated SVOCs and pesticides.	Retained	Glycolate/Alkaline Polyethylene Glycol (APEG) dehalogenation is one of the few processes available other than incineration that has been successfully field tested in treating PCBs. The technology can be used but may be less effective against selected halogenated VOCs. The technology is amenable to small-scale applications. High clay and moisture content will increase treatment costs.	High	Retained
	Physical	Separation	Separation processes are used for removing contaminated concentrates from soils, to leave relatively uncontaminated fractions that can then be regarded as treated soil. Physical separation often precedes chemical extraction treatment based on the assumption that most of the contamination is tied to the finer soil fraction, which alone may need to be treated.	Physical separation processes can achieve high throughputs with relatively small equipment.	Retained	The high moisture content and variety of impacted materials (sediment, vegetation, and paint chips) would make consistent separation of impacted material problematic. Not a stand alone treatment.	Low to Medium	Eliminated
		Solidification/Stabilization	Contaminants are physically bound or enclosed within a stabilized mass (solidification), or chemical reactions are induced between the stabilizing agent and contaminants to reduce their mobility (stabilization).	The target contaminant group is inorganics. Most S/S technologies have limited effectiveness against organics and pesticides, except vitrification which destroys most organic contaminants	Eliminated			
	Thermal	Incineration	High temperatures, 870-1,200 °C (1,600- 2,200 °F), are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	Incineration is used to remediate soils contaminated with hazardous wastes, particularly chlorinated hydrocarbons, PCBs, and dioxins.	Retained	Only one off-site incinerator is permitted to burn PCBs and dioxins. There are specific feed size and materials handling requirements that can impact applicability or cost at specific sites.	High	Eliminated

Table 13. Screening of Potential Remediation Technologies and Process Options, continued

General Response Action	Remediation Technology	Process Option	Description	Initial Screening: Implementability	Initial Screening: Screening Decision	Final Screening: Effectiveness	Final Screening: Cost	Final Screening: Screening Decision
Ex-Situ Treatment	Thermal	Pyrolysis	Chemical decomposition is induced in organic materials by heat in the absence of oxygen. Organic materials are transformed into gaseous components and a solid residue (coke) containing fixed carbon and ash.	The target contaminant groups for pyrolysis are SVOCs and pesticides. Chemical contaminants for which treatment data exist include PCBs, dioxins, PAHs, and many other organics	Retained	Pyrolysis is an emerging technology. Although the basic concepts of the process have been validated, the performance data for an emerging technology have not been evaluated according to methods approved by EPA and adhering to EPA quality assurance/quality control standards. High moisture content increases treatment costs.	High	Eliminated
		Thermal Desorption	Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. High Temperature Thermal Desorption (HTTD) is applicable to PCBs.	HTTD technology is readily available as mobile units which would need to be set up at a fixed location in close proximity to the contaminated sediments.	Retained	HTTD is frequently used in combination with incineration, solidification/stabilization, or dechlorination, depending upon site-specific conditions. Clay and silty soils and high humic content soils increase reaction time as a result of binding of contaminants.	Medium to High	Retained
Disposal	On Site Disposal	RCRA or Modified RCRA Repository	Contaminated material is removed and placed in a constructed on site repository with top and bottom liners and a leachate collection system.	Materials and labor are readily available and the technology is proven. Would require finding a suitable repository site. Administrative feasibility may be questionable because of land ownership and long-term maintenance and monitoring responsibilities.	Eliminated			
	Off Site Disposal	Solid Waste Landfill	Contaminated material is removed and transported to permitted off-site solid waste disposal facility. Pretreatment may be required.	Implemented in conjuction with a removal process option. The constructions steps required (loading and hauling) are considered standard construction practices. Key project components, such as the availability of equipment, materials, and a landfill with adequate capacity are present.	Retained	This alternative would effectively reduce contaminant mobility at the site by removing the contaminant sources. Contaminant toxicity and volume would not be reduced, but would be permanently transferred to a safer physical location. The nearest landfill facility with adequate capacity is located in Great Falls, MT.	Medium	Retained
		TSCA Landfill	Contaminated material is removed and transported to permitted off-site TSCA disposal facility. Pretreatment may be required.	Implemented in conjuction with a removal process option. The constructions steps required (loading and hauling) are considered standard construction practices. Key project components, such as the availability of equipment, materials, and a TSCA facility with adequate capacity, are present.	Retained	This alternative would effectively reduce contaminant mobility at the site by removing the contaminant sources. Contaminant toxicity and volume would not be reduced, but would be permanently transferred to a safer physical location. The nearest TSCA disposal facilities are located near Grand View, ID and Knoll, UT.	High	Retained

Table 14. Summary of Retained General Response Actions, Remediation Technologies, and Process Options

General Response Action	Remediation Technology	Process Option
No Action	None	Not applicable
Monitored Natural Recovery	Physical degradation, biological degradation, physical burial	Combination of Desorption, Diffusion, Dilution, Volatilization, Resuspension, and Transport
Institutional Controls	Administrative Restrictions	Fish Consumption Restrictions, Deed Restrictions, Declaration of Restrictive Covenants, Controlled Ground Water Area
Containment	Capping	In-situ Capping
Removal	Dredging	Mechanical Dredging
Removal	Dredging	Hydraulic Dredging
Removal	Dry Excavation	Excavator
Ex-Situ Treatment	Chemical	Dehalogenation
Ex-Situ Treatment	Thermal	Thermal Desorption
Disposal	Off Site Disposal	Solid Waste Landfill
Disposal	Off Site Disposal	TSCA Landfill

Table 15. Criteria for Detailed Analyes of Alternatives

<table>
<tr><th colspan="5">Threshold Criteria</th></tr>
<tr><td colspan="2">Overall Protection of Human Health and the Environment</td><td colspan="3">Compliance with ARARs</td></tr>
<tr><td colspan="2" rowspan="4">● How alternative provides human health and environmental protection</td><td colspan="3">● Compliance with chemical-specific ARARs</td></tr>
<tr><td colspan="3">● Compliance with action-specific ARARs</td></tr>
<tr><td colspan="3">● Compliance with location-specific ARARs</td></tr>
<tr><td colspan="3">● Compliance with other criteria, advisories, and guidance</td></tr>
<tr><th colspan="5">Primary Balancing Criteria</th></tr>
<tr><th>Long-Term Effectiveness and Permanence</th><th>Reduction of Toxicity, Mobility, or Volume Through Treatment</th><th>Short-Term Effectiveness</th><th>Implementability</th><th>Cost</th></tr>
<tr><td>● Magnitude of residual risk
● Adequacy and reliability of controls</td><td>● Treatment process used and materials treated
● Amount of hazardous material destroyed or treated
● Degree of expected reductions in toxicity, mobility, and volume
● Degree to which treatment is irreversible
● Type and quantity of residuals remaining after treatment</td><td>● Protection of community during removal actions
● Protection of workers during removal actions
● Environmental impacts
● Time until removal action objectives are achieved</td><td>● Ability to construct and operate the technology
● Reliability of the treatment
● Ease of the treatment
● Ease of undertaking additonal removal actions, if necessary
● Ability to obtain approvals from other agencies
● Coordination with other agencies
● Availability of off-site treatment, storage and disposal services and capability
● Availability of necessary equipment and specialists
● Availability of prospective technologies</td><td>● Capital costs
● Operating and maintenance costs
● Present worth cost</td></tr>
<tr><th colspan="5">Modifying Criteria</th></tr>
<tr><td colspan="3">Supporting Agency Acceptance[a]</td><td colspan="2">Community Acceptance[a]</td></tr>
<tr><td colspan="3">● Features of the alternative the agencies support
● Features of the alternative about which the supporting agencies have reservations
● Elements of the alternative the supporting agencies strongly oppose</td><td colspan="2">● Features of the alternative the community supports
● Features about which the community has reservations
● Elements of the alternative the community strongly opposes</td></tr>
<tr><td colspan="5">[a]These criteria are assessed primarily following public comment on the FS</td></tr>
</table>

Table 16. Comparison of Pre- and Post-Dredging Mean and 95% UCLs of Mean PCB Concentrations in Stream Sediment by Subreach for Alternative 2, 3, and 4

Subreach	PCB Concentration (µg/kg)										
	Pre-Dredging			Post-Dredging - Alternative 2A, 3A, and 4A				Post-Dredging - Alternative 2B, 3B, and 4B			
	Mean	95% UCL	Recommended UCL Method	Mean	95% UCL	Recommended UCL Method	% UCL Reduction	Mean	95% UCL	Recommended UCL Method	% UCL Reduction
2A	4785	6761	95% H-UCL	117.5	218.8	95% Chebyshev(Mean, Sd)*	96.8%	117.5	218.8	95% Chebyshev(Mean, Sd)*	96.8%
2B	210.8	657.2	95% Chebyshev(Mean, Sd)*	174.3	615.1	95% Chebyshev(Mean, Sd)	6.4%	174.3	615.1	95% Chebyshev(Mean, Sd)	6.4%
3A	916	2315	95% Chebyshev(Mean, Sd)*	219.5	703.3	95% Chebyshev(Mean, Sd)*	69.6%	219.5	703.3	95% Chebyshev(Mean, Sd)*	69.6%
3B	103.4	214.5	95% Chebyshev(Mean, Sd)*	76.01	151.2	95% Chebyshev(Mean, Sd)	29.5%	103.4	214.5	95% Chebyshev(Mean, Sd)*	0.0%
4A	52.56	106.9	95% Chebyshev(Mean, Sd)	58.12	96.28	95% Chebyshev(Mean, Sd)	9.9%	52.56	106.9	95% Chebyshev(Mean, Sd)	0.0%
4B	78.61	174.2	95% Chebyshev(Mean, Sd)	62.72	73.98	95% Chebyshev(Mean, Sd)	57.5%	78.61	174.2	95% Chebyshev(Mean, Sd)	0.0%

Note:

Nondetect concentrations estimated using LnROS method.

PCB Concentrations in µg/kg

95% UCL of mean PCB concentrations are for depth intervals H1 through H4 of Herrera data (Herrera, 2006)

Residual PCB concentrations assumed to be 69 ug/kg in dredged areas in depth intervals H1 and H2

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

Table 17. Sensitivity of Post-Dredging 95% UCLs of Mean PCB Concentrations in Stream Sediment to Residual PCB Concentrations for Alternatives 2A, 3A, and 4A

Subreach	95% UCL of Mean PCB Concentration (µg/kg)						UCL Ratio	
	0 µg/kg PCB Concentration in Dredged Areas		69 µg/kg PCB Concentration in Dredged Areas		100 µg/kg PCB Concentration in Dredged Areas			
	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	95% UCL	Recommended UCL Method	0 µg/kg/69 µg/kg	100 µg/kg/69 µg/kg
2A	189.4	95% Chebyshev(Mean, Sd)	218.8	95% Chebyshev(Mean, Sd)*	233	95% Chebyshev(Mean, Sd)*	86.6%	106.5%
2B	579.2	95% Chebyshev(Mean, Sd)	615.1	95% Chebyshev(Mean, Sd)	631.4	95% Chebyshev(Mean, Sd)*	94.2%	102.6%
3A	671	95% Chebyshev(Mean, Sd)	703.3	95% Chebyshev(Mean, Sd)*	718	95% Chebyshev(Mean, Sd)*	95.4%	102.1%
3B	116.9	95% Chebyshev(Mean, Sd)	151.2	95% Chebyshev(Mean, Sd)	168.7	95% Chebyshev(Mean, Sd)	77.3%	111.6%
4A	61.02	95% Chebyshev(Mean, Sd)	96.28	95% Chebyshev(Mean, Sd)	114.1	95% Chebyshev(Mean, Sd)	63.4%	118.5%
4B	59.8	95% Chebyshev(Mean, Sd)	73.98	95% Chebyshev(Mean, Sd)	111	95% Chebyshev(Mean, Sd)	80.8%	150.0%

Note:

Nondetect concentrations estimated using LnROS method.

95% UCL of mean PCB concentrations are for depth intervals H1 through H4 of Herrera data (Herrera, 2006)

95% UCL of mean PCB concentrations are for depth intervals H1 through H4

Residual PCB concentrations assumed to be 0, 69, and 100 ug/kg in dredged areas in depth intervals H1 and H2 for sensitivity analysis

*99% or 97.5% UCL recommended by ProUCL, but 95% UCL reported for consistent comparisons

Table 18. Summary of Assumed Parameters for Mechanical Dredging Costs

Item	Units	Alternative 2A	Alternative 2B	Alternative 5	Comment	Source
Work Times						
Dredging Area	SF	639000	259000	639000		
Dredging Depth	Feet	0.5	0.5	3		
Dredging Quantity	CY	11830	4800	71000		
Dredging Rate	CY/Hr	20	20	20		
Total Dredge Time	Hours	592	240	3550		
Daily Dredge Time	Hr/Day	8	8	8		
Work Rate	Hr/Day	10	10	10		
Dredge Days	Day	74	30	444		
Work Days	Day	84	40	454	Dredge Days + 10 for mob/demob and sediment disposal	
Average Working Days/Month	Day/Mo	22	22	22		
Months	Mo	3.8	1.8	20.6		
Material Quantities						
Dry Unit Weight	LB/CY	3250	3250	3250		
Moist Unit Weight	LB/CY	3500	3500	3500		
Dry Weight	Ton	19223.75	7800	115375		
% Fines by Wt	%	0.42	0.42	0.42		
Removal Weight	Dry Ton	8080	3280	48460		
Disposal Weight	Wet Ton	8710	3540	52190		
Water Weight (saturated)	Ton	630	260	3730		
Entrained Water Volume	CF	159750	64750	159750	3" Layer in bucket over entire site area	
Entrained Water Weight	LB	4984.2	2020.2	4984.2		
Water Weight	Ton	5299.2	2150.2	6849.2	1/2 saturated water plus entrained water	
Vol Water	Gal	1270449	515497	1642052		
Flow Rate	Gal/Day	17168	17183	3698		
Flow Rate	Gal/Hr	1717	1718	370		
Flow Rate	Gal/Min	29	29	6		
Fine Sediment (1/4" minus)	CY	5000	2000	30000		

Table 18. Summary of Assumed Parameters for Mechanical Dredging Costs, continued

		Alternative				
Item	Units	2A	2B	5	Comment	Source
Sediment Control Barriers						
Stream Length	Feet	14600	6550	14600		
Barriers Section Length	Feet	200	200	200		
Number of Setups	Ea	73	33	73		
Cost Per Setup	$/setup	3000	3000	3000		
Barrier Cost	$	219000	99000	219000		
Equipment Unit Rates						
Hydraulic Excavator	$/CY	2.05	2.05	2.05	1 CY excavator, 100 CY/Hr	Means 31 23 16.42 0200
Capacity correction	$/CY	10.25	10.25	10.25	Estimated production 20 CY/HR	Engineering estimate
Truck loading correction	$/CY	1.845	1.845	1.845	For loading onto trucks, add 15%	Means 31 23 16.42 0020
Wet excavation correction	$/CY	6.15	6.15	6.15	Wet excavation, add 50%	Means 31 23 16.42 4250
Adjusted Excavator Cost	$/CY	18.25	18.25	18.25		
Haul Truck	$/CY	4.17	4.17	4.17	22 CY off road truck, 15 min Ld/Uld, 5 MPH, 0.5 m	Means 31 23 23.20 5310
Wheel Loader	$/CY	2.66	2.66	2.66	3/4 CY 45 CY/Hr	Means 31 23 16.42 1500
Truck loading correction	$/CY	0.399	0.399	0.399	For loading onto trucks, add 15%	Means 31 23 16.42 0020
Wet excavation correction	$/CY	1.33	1.33	1.33	Wet excavation, add 50%	Means 31 23 16.42 4250
Adjusted Loader Cost	$/CY	4.39	4.39	4.39		
Clearing						
Clearing brush by Saw	$/Acre	1700	1700	1700		Means 31 13 13.10 0020
Reclamation						
Vegetation Clearing	Acre	3.4	1.5	3.4	One side stream length x 10' wide	
Central Sed. Processing Area	Acre	2	2	2		
Haul Roads	Acre	3.7	3.7	3.7	3 miles, 10 feet wide	
Total	Acre	9.1	7.2	9.1		

Table 19. Preliminary Cost for Alternative 2A: Partial Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	135825	$135,825	8%
Site Preparation					
Clearing and Grubbing	3.4	Acre	1,700	$5,780	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Mechanical Dredging					
Sediment Control Barriers	1	LS	219,000	$219,000	
Excavate and Load	11830	CY	18.25	$215,898	Hydraulic excavator
Haul	11830	CY	4.17	$49,331	Off road haul truck
Dewatering/Water Treatment					
Load Dewatering Boxes	11830	CY	4.39	$51,934	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	4	Mo	55,857.51	$223,430	Rain for Rent
PCB Sampling and Analysis	168	Ea	100	$16,800	2 samples per day
Screening and Sorting					
Screen	11,830	CY	4	$47,320	Estimate
Additonal Fine Sediment	5,000	CY	10	$50,000	Estimate
Material Handling/Blending	5,000	CY	18.25	$91,250	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	11830	CY	2.66	$31,468	Wheel loader
Hauling Clean Sediment	11830	CY	4.17	$49,331	Off road haul truck
Placement/Grading of Clean Sediment	11830	CY	18.25	$215,898	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	5000	CY	4.17	$20,850	Wheel loader
Waste Transportation	8710	Ton	25	$217,750	
Waste Disposal	8710	Ton	7	$60,970	Montana Waste Systems
Reclamation					
Grading and Contouring	9.1	Ac	2,000	$18,200	
Seed/Fertilize	9.1	Ac	2,000	$18,200	
Mulch	9.1	Ac	2,000	$18,200	
Subtotal				$1,833,640	
Pilot Test	1	LS	150,000	$150,000	
Design	7%			$128,355	ASCE
Construction Oversight	15%			$275,046	
Subtotal Capital Costs				$2,387,040	
Contingency	10%			$238,704	
TOTAL CAPITAL COSTS				$2,625,745	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$2,625,745	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$2,803,194	

Table 20. Preliminary Cost for Alternative 2B: Partial Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	62,965	$62,965	8%
Site Preparation					
Clearing and Grubbing	1.5	Acre	1,700	$2,550	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Mechanical Dredging					
Sediment Control Barriers	1	LS	99,000	$99,000	
Excavate and Load	4800	CY	18.25	$87,600	Hydraulic excavator
Haul	4800	CY	4.17	$20,016	Off road haul truck
Dewatering/Water Treatment					
Load Dewatering Boxes	4800	CY	4.39	$21,072	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	2	Mo	55,857.51	$111,715	Rain for Rent
PCB Sampling and Analysis	80	Ea	100	$8,000	2 samples per day
Screening and Sorting					
Screen	4,800	CY	4	$19,200	Estimate
Additonal Fine Sediment	2,000	CY	10	$20,000	Estimate
Material Handling/Blending	2,000	CY	18.25	$36,500	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	4800	CY	2.66	$12,768	Wheel loader
Hauling Clean Sediment	4800	CY	4.17	$20,016	Off road haul truck
Placement/Grading of Clean Sediment	4800	CY	18.25	$87,600	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	2000	CY	4.17	$8,340	Wheel loader
Waste Transportation	3540	Ton	25	$88,500	
Waste Disposal	3540	Ton	7	$24,780	Montana Waste Systems
Reclamation					
Grading and Contouring	7.2	Ac	2,000	$14,400	
Seed/Fertilize	7.2	Ac	2,000	$14,400	
Mulch	7.2	Ac	2,000	$14,400	
Subtotal				$850,028	
Pilot Test	1	LS	150,000	$150,000	
Design	7.5%			$63,752	ASCE
Construction Oversight	15%			$127,504	
Subtotal Capital Costs				$1,191,284	
Contingency	10%			$119,128	
TOTAL CAPITAL COSTS				$1,310,413	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$1,310,413	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$1,487,862	

Table 21. Summary of Assumed Parameters for Hydraulic Dredging Costs

Item	Units	Alternative			Comment	Source
		3A	3B	6		
Work Times						
Dredge Rate	SF/hr	500	500	2000		
Dredging Area	SF	639,000	259,000	639,000		
Total Dredge Time	Hours	1278	518	320		
Daily Dredge Time	Hr/Day	8	8	8		
Work Rate	Hr/Day	10	10	10		
Dredge Days	Day	160	65	40		
Work Days	Day	170	75	50	Dredge Days + 10 for mob/demob and sediment disposal	
Average Working Days/Month	Day/Mo	22	22	22		
Months	Mo	7.7	3.4	2.3		
Material Quantities						
Dredge Depth	Feet	0.5	0.5	3		
Sediment Volume (all size)	CY	11830	4800	71000		
Dry Unit Weight	LB/CY	3250	3250	3250		
Moist Unit Weight	LB/CY	3500	3500	3500		
Dry Weight	Ton	19223.75	7800	115375		
% Fines by Wt		0.42	0.42	0.42		
Removal Weight	Dry Ton	8,080	3,280	48,460		
Disposal Weight	Wet Ton	8,710	3,540	52,190		
%Solids by Wt	%	0.05	0.05	0.05		
Wt Water	Ton	153,520	62,320	920,740		
Vol Water	Gal	36805436	14940821	220741513		
Flow Rate	Gal/min	1000	1000	2300		Keene Engineering
Fine Sediment (1/4" minus)	CY	5000	2,000	30,000		
Dredge Rate	CY/Hr	3.9	3.9	93.8		

Table 21. Summary of Assumed Parameters for Hydraulic Dredging Costs, continued

Item	Units	Alternative 3A	Alternative 3B	Alternative 6	Comment	Source
Dredge Rate						
Dredge Cost	$	35000.00	35000.00	25000.00	Purchase cost for 4A, 4B. Monthly rental for 5	Keene Engineering
Dredge Cost/day	$/Day	218.75	538.46	1136.36		
Dredge operating (fuel, etc.)	$/Day	100.00	100.00	400.00		
Daily Dredging Cost Subtotal	$/Day	318.75	638.46	1536.36		
Contractor Overhead and Profit	14%	44.63	89.38	215.09		
Daily Dredging Cost		363.38	727.84	1751.45		
Sediment Control Barriers						
Stream Length	Feet	14600	6550	14600		
Barriers Section Length	Feet	200	200	200		
Number of Setups	Ea	73	33	73		
Cost Per Setup	$/setup	3000	3000	3000		
Barrier Cost	$	219000	99000	219000		
Reclamation						
Area per Staging Area	Acre	2	2	2		
Stream Length	Feet	14600	6550	14600		
Length per Staging Area	Feet	2000	2000	2000		
Number of Staging Areas	Ea	8	4	8		
Total Staging Area	Acre	16	8	16		
Labor Rates						
Labor						
Foreman	$/Hour	62	62	62		
Laborer	$/Hour	50	50	50		
Crew Per diem	$/Day	23	23	23		
Lodging	$/Day	70	70	70		
Equipment						
Wheel Loader	$/CY	2.66	2.66	2.66	3/4 CY 45 CY/Hr	Means 31 23 16.42 1500
Truck loading correction	$/CY	0.40	0.40	0.40	For loading onto trucks, add 15%	Means 31 23 16.42 0020
Wet excavation correction	$/CY	1.33	1.33	1.33	Wet excavation, add 50%	Means 31 23 16.42 4250
Adjusted Loader Cost	$/CY	4.39	4.39	4.39		

Table 22. Alternative 3A: Partial Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredge with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	137,833	$137,833	8%
Site Preparation					
Sediment Processing Area Prep.	8	LS	5,000	$40,000	Estimate
Dredging					
Sediment Control Barriers	1	LS	219000	$219,000	
Dredge Mobilization	1	LS	10000	$10,000	
Dredge	160	Day	363	$58,140	
Foreman	1,700	Hr	62.00	$105,400	
Laborers (3)	5,100	Hr	50.00	$255,000	
Per diem	680	Day	23.00	$15,640	
Lodging	680	Day	75.00	$51,000	
Support Vehicles	170	Day	100.00	$17,000	
Misc. Equipment (Hoses, ect.)	1	LS	20,000.00	$20,000	
Dewatering/Water Treatment System					
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	8	Mo	55,857.51	$446,860	Rain for Rent
PCB Sampling and Analysis	320	Ea	100	$32,000	2 samples per day
Transportation and Disposal					
Sediment Collection and Loading	5,000	CY	4.39	$21,950	
Waste Transportation	8,710	Ton	25.00	$217,750	
Waste Disposal	8,710	Ton	7.00	$60,970	Montana Waste Systems
Reclamation					
Grading and Contouring	16	Acre	2000	$32,000	
Seed/Fertilize	16	Acre	2,000	$32,000	
Mulch	16	Acre	2,000	$32,000	
Subtotal				$1,860,749	
Pilot Test	1	LS	150,000	$150,000	
Design	7.0%			$130,252	ASCE
Construction Oversight	15%			$279,112	
Subtotal Capital Costs				$2,420,114	
Contingency	10%			$242,011	
TOTAL CAPITAL COSTS				$2,662,125	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$2,662,125	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$2,839,575	

Table 23. Alternative 3B: Partial Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredge with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	68,392	$68,392	8%
Site Preparation					
Sediment Processing Area Prep.	4	LS	5,000	$20,000	Estimate
Dredging					
Sediment Control Barriers	1	LS	99000	$99,000	
Dredge Mobilization	1	LS	10000	$10,000	
Dredge	65	Day	728	$47,310	
Foreman	750	Hr	62.00	$46,500	
Laborers (3)	2,250	Hr	50.00	$112,500	
Per diem	300	Day	23.00	$6,900	
Lodging	300	Day	75.00	$22,500	
Support Vehicles	75	Day	100.00	$7,500	
Misc. Equipment (Hoses, ect.)	1	LS	20,000.00	$20,000	
Dewatering/Water Treatment System					
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	4	Mo	55,857.51	$223,430	Rain for Rent
PCB Sampling and Analysis	130	Ea	100	$13,000	2 samples per day
Transportation and Disposal					
Sediment Collection and Loading	2,000	CY	4.39	$8,780	
Waste Transportation	3,540	Ton	25.00	$88,500	
Waste Disposal	3,540	Ton	7.00	$24,780	Montana Waste Systems
Reclamation					
Grading and Contouring	8	Acre	2000	$16,000	
Seed/Fertilize	8	Acre	2,000	$16,000	
Mulch	8	Acre	2,000	$16,000	
Subtotal				$923,298	
Pilot Test	1	LS	150,000	$150,000	
Design	7.5%			$69,247	ASCE
Construction Oversight	15%			$138,495	
Subtotal Capital Costs				$1,281,040	
Contingency	10%			$128,104	
TOTAL CAPITAL COSTS				$1,409,144	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$1,409,144	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$1,586,593	

Table 24. Summary of Assumed Parameters for Dry Excavation Costs

Item	Units	Alternative 4A	Alternative 4B	Alternative 7	Comment	Source
Work Times						
Excavation Area	SF	639,000	259,000	639,000		
ExcavationDepth	Feet	0.5	0.5	3		
Excavation Quantity	CY	11830	4,800	71000		
Excavation Rate	CY/Hr	75	75	75		
Total Excavation Time	Hours	158	64	947		
Daily Excavation Time	Hr/Day	8	8	8		
Work Rate	Hr/Day	10	10	10		
Excavation Days	Day	20	8	119		
Work Days	Day	30	18	129	Excavation Days + 10 for mob/demob and sediment disposal	
Average Working Days/Month	Day/Mo	22	22	22		
Months	Mo	1.4	0.8	5.9		
Material Quantities						
Dry Unit Weight	LB/CY	3250	3250	3250		
Moist Unit Weight	LB/CY	3500	3500	3500		
Dry Weight	Ton	19223.75	7800	115375		
% Fines by Wt		0.42	0.42	0.42		
Removal Weight (Fines)	Dry Ton	8,080	3,280	48,460		
Disposal Weight (Fines)	Wet Ton	8,710	3,540	52,190		
Water Weight (saturated)	Ton	630	260	3,730		
Water Weight	Ton	315	130	1,865	1/2 saturated water plus entrained water	
Vol Water	Gal	75,519	31,167	447,122		
Flow Rate	Gal/Day	3,776	3,896	3,757		
Flow Rate	Gal/Hr	378	390	376		
Flow Rate	Gal/Min	6.3	6.5	6.3		
Fine Sediment (1/4" minus)	CY	5000	2000	30000		
Labor Rates						
Labor						
Foreman	$/Hour	62	62	62		
Laborer	$/Hour	50	50	50		
Crew Per diem	$/Day	23	23	23		
Lodging	$/Day	70	70	70		

Table 24. Summary of Assumed Parameters for Dry Excavation Costs, continued

Item	Units	Alternative			Comment	Source
		4A	4B	7		
Equipment Unit Rates						
Hydraulic Excavator	$/CY	2.05	2.05	2.05	1 CY excavator, 100 CY/Hr	Means 31 23 16.42 0200
Capacity correction	$/CY	3.59	3.59	3.59	Estimated production 75 CY/HR	Engineering estimate
Truck loading correction	$/CY	0.85	0.85	0.85	For loading onto trucks, add 15%	Means 31 23 16.42 0020
Wet excavation correction	$/CY	2.82	2.82	2.82	Wet excavation, add 50%	Means 31 23 16.42 4250
Adjusted Excavator Cost	$/CY	7.25	7.25	7.25		
Haul Truck	$/CY	4.17	4.17	4.17	22 CY off road truck, 15 min Ld/Uld, 5 MPH, 0.5 m	Means 31 23 23.20 5310
Wheel Loader	$/CY	2.66	2.66	2.66	3/4 CY 45 CY/Hr	Means 31 23 16.42 1500
Truck loading correction	$/CY	0.399	0.399	0.399	For loading onto trucks, add 15%	Means 31 23 16.42 0020
Wet excavation correction	$/CY	1.33	1.33	1.33	Wet excavation, add 50%	Means 31 23 16.42 4250
Adjusted Loader Cost	$/CY	4.39	4.39	4.39		
Clearing						
Clearing brush by Saw	$/Acre	1700	1700	1700		Means 31 13 13.10 0020
Reclamation						
Stream Length	Feet	14600	6550	14600		
Vegetation Clearing	Acre	3.4	1.5	3.4	One side stream length x 10' wide	
Central Sed. Processing Area	Acre	2	2	2		
Haul Roads	Acre	4	4	4	3 miles, 10 feet wide	
Total	Acre	9.4	7.5	9.4		

Table 25. Alternative 4A: Partial Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	136,515	$136,515	8%
Site Preparation					
Clearing and Grubbing	3.4	Ac	1,700	$5,780	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Stream Diversion					
System Mob/Demob	1	LS	238,591.00	$238,591	Rain for Rent
System Rental	2	Mo	157,475.00	$314,950	Rain for Rent
24/7 Daily Monitoring	2	Mo	60,480.00	$120,960	Rain for Rent
Dry Excavation					
Excavate and Load	11,830	CY	7.25	$85,768	Hydraulic excavator
Haul to Processing Area	11,830	CY	4.17	$49,331	Off road truck
Dewatering/Water Treatment					
Load Dewatering Boxes	11,830	CY	4.39	$51,934	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	2	Mo	55,857.51	$111,715	Rain for Rent
PCB Sampling and Analysis	60	Ea	100	$6,000	2 samples per day
Screening and Sorting					
Screen	11,830	CY	4	$47,320	Estimate
Additonal Fine Sediment	5,000	CY	10	$50,000	Estimate
Material Handling/Blending	11,830	CY	2.05	$24,252	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	11,830	CY	2.66	$31,468	Wheel loader
Hauling Clean Sediment	11,830	CY	4.17	$49,331	Off road haul truck
Placement/Grading of Clean Sediment	11,830	CY	7.25	$85,768	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	5,000	CY	4.39	$21,950	Wheel loader
Waste Transportation	8,710	Ton	25	$217,750	
Waste Disposal	8,710	Ton	7	$60,970	Montana Waste Systems
Reclamation					
Grading and Contouring	9.4	Ac	2,000	$18,800	
Seed/Fertilize	9.4	Ac	2,000	$18,800	
Mulch	9.4	Ac	2,000	$18,800	
Subtotal				$1,842,957	
Design	7.0%			$129,007	ASCE
Construction Oversight	15%			$276,444	
Subtotal Capital Costs				$2,248,408	
Contingency	10%			$224,841	
TOTAL CAPITAL COSTS				$2,473,249	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$2,473,249	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$2,650,698	

Table 26. Alternative 4B: Partial Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	76,347	$76,347	8%
Site Preparation					
Clearing and Grubbing	1.5	Ac	1,700	$2,550	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Stream Diversion					
System Mob/Demob	1	LS	238,591.00	$238,591	Rain for Rent
System Rental	1	Mo	157,475.00	$157,475	Rain for Rent
24/7 Daily Monitoring	1	Mo	60,480.00	$60,480	Rain for Rent
Dry Excavation					
Excavate and Load	4,800	CY	7.25	$34,800	Hydraulic excavator
Haul to Processing Area	4,800	CY	4.17	$20,016	Off road truck
Dewatering/Water Treatment					
Load Dewatering Boxes	4,800	CY	4.39	$21,072	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	1	Mo	55,857.51	$55,858	Rain for Rent
PCB Sampling and Analysis	36	Ea	100	$3,600	2 samples per day
Screening and Sorting					
Screen	4,800	CY	4	$19,200	Estimate
Additonal Fine Sediment	2,000	CY	10	$20,000	Estimate
Material Handling/Blending	4,800	CY	2.05	$9,840	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	4,800	CY	2.66	$12,768	Wheel loader
Hauling Clean Sediment	4,800	CY	4.17	$20,016	Off road haul truck
Placement/Grading of Clean Sediment	4,800	CY	7.25	$34,800	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	2,000	CY	4.39	$8,780	Wheel loader
Waste Transportation	3,540	Ton	25	$88,500	
Waste Disposal	3,540	Ton	7	$24,780	Montana Waste Systems
Reclamation					
Grading and Contouring	7.5	Ac	2,000	$15,000	
Seed/Fertilize	7.5	Ac	2,000	$15,000	
Mulch	7.5	Ac	2,000	$15,000	
Subtotal				$1,030,679	
Design	7.5%			$77,301	ASCE
Construction Oversight	15%			$154,602	
Subtotal Capital Costs				$1,262,581	
Contingency	10%			$126,258	
TOTAL CAPITAL COSTS				$1,388,839	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$1,388,839	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$1,566,289	

Table 27. Alternative 5: Complete Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	658,949	$658,949	8%
Site Preparation					
Clearing and Grubbing	3.4	Acre	1,700	$5,780	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Mechanical Dredging					
Sediment Control Barriers	1	LS	219,000	$219,000	
Excavate and Load	71000	CY	18.25	$1,295,750	Hydraulic excavator
Haul	71000	CY	4.17	$296,070	Off road haul truck
Dewatering/Water Treatment					
Load Dewatering Boxes	71000	CY	4.39	$311,690	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	21	Mo	55,857.51	$1,173,008	Rain for Rent
PCB Sampling and Analysis	908	Ea	100	$90,800	2 samples per day
Screening and Sorting					
Screen	71,000	CY	4	$284,000	Estimate
Additonal Fine Sediment	30,000	CY	10	$300,000	Estimate
Material Handling/Blending	30,000	CY	18.25	$547,500	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	71000	CY	2.66	$188,860	Wheel loader
Hauling Clean Sediment	71000	CY	4.17	$296,070	Off road haul truck
Placement/Grading of Clean Sediment	71000	CY	18.25	$1,295,750	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	30000	CY	4.39	$131,700	Wheel loader
Waste Transportation	52190	Ton	25	$1,304,750	
Waste Disposal	52190	Ton	7	$365,330	Montana Waste Systems
Reclamation					
Grading and Contouring	9.1	Ac	2,000	$18,200	
Seed/Fertilize	9.1	Ac	2,000	$18,200	
Mulch	9.1	Ac	2,000	$18,200	
Subtotal				$8,895,813	
Pilot Test	1	LS	150,000	$150,000	
Design	6.1%			$542,645	ASCE
Construction Oversight	15%			$1,334,372	
Subtotal Capital Costs				$10,922,829	
Contingency	10%			$1,092,283	
TOTAL CAPITAL COSTS				$12,015,112	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$12,015,112	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$12,192,561	

Table 28. Alternative 6: Complete Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredging with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	277,737	$277,737	8%
Site Preparation					
Sediment Processing Area Prep.	8	LS	5,000	$40,000	Estimate
Dredging					
Sediment Control Barriers	1	LS	219,000	$219,000	
Dredge Mobilization	1	LS	15,000	$15,000	
Dredge	40	Day	1,751	$70,058	
Foreman	500	Hr	62.00	$31,000	
Laborers (3)	1,500	Hr	50.00	$75,000	
Per diem	200	Day	23.00	$4,600	
Lodging	200	Day	75.00	$15,000	
Support Vehicles	50	Day	100.00	$5,000	
Misc. Equipment (Hoses, ect.)	1	LS	20,000	$20,000	
Dewatering/Water Treatment System					
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	3	Mo	55,857.51	$167,573	Rain for Rent
PCB Sampling and Analysis	80	Ea	100	$8,000	2 samples per day
Stream Reconstruction					
Additonal Fine Sediment	30,000	CY	10	$300,000	
Placement/Grading of Clean Sediment	30,000	CY	18.25	$547,500	
Transportation and Disposal					
Sediment Collection and Loading	30,000	CY	4.39	$131,700	
Waste Transportation	52,190	Ton	25.00	$1,304,750	
Waste Disposal	52,190	Ton	7.00	$365,330	Montana Waste Systems
Reclamation					
Grading and Contouring	16	Acre	2,000	$32,000	
Seed/Fertilize	16	Acre	2,000	$32,000	
Mulch	16	Acre	2,000	$32,000	
Subtotal				$3,749,454	
Pilot Test	1	LS	150,000	$150,000	
Design	6.5%			$243,714	
Construction Oversight	15%			$562,418	
Subtotal Capital Costs				$4,705,586	
Contingency	10%			$470,559	
TOTAL CAPITAL COSTS				$5,176,145	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$5,176,145	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$5,353,594	

Table 29. Alternative 7: Complete Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill

Task	Quantity	Units	Unit $	Cost $	Comment
Mobilization, Bonding & Insurance	1	L.S.	535,934	$535,934	8%
Site Preparation					
Clearing and Grubbing	3.4	Ac	1,700	$5,780	Estimate
Sediment Processing Area Prep.	1	LS	20,000	$20,000	Estimate
Stream Diversion					
System Mob/Demob	1	LS	238,591.00	$238,591	Rain for Rent
System Rental	6	Mo	157,475.00	$944,850	Rain for Rent
24/7 Daily Monitoring	6	Mo	60,480.00	$362,880	Rain for Rent
Dry Excavation					
Excavate and Load	71,000	CY	7.25	$514,750	Hydraulic excavator
Haul to Processing Area	71,000	CY	4.17	$296,070	Off road truck
Dewatering/Water Treatment					
Load Dewatering Boxes	71,000	CY	4.39	$311,690	Wheel loader
System Mob/Demob	1	LS	56,206.00	$56,206	Rain for Rent
System Operation	6	Mo	55,857.51	$335,145	Rain for Rent
PCB Sampling and Analysis	258	Ea	100	$25,800	2 samples per day
Screening and Sorting					
Screen	71,000	CY	4	$284,000	Estimate
Additonal Fine Sediment	30,000	CY	10	$300,000	Estimate
Material Handling/Blending	71,000	CY	2.05	$145,550	Hydraulic excavator
Stream Reconstruction					
Loading Clean Sediment	71,000	CY	2.66	$188,860	Wheel loader
Hauling Clean Sediment	71,000	CY	4.17	$296,070	Off road haul truck
Placement/Grading of Clean Sediment	71,000	CY	7.25	$514,750	Hydraulic excavator
Transportation and Disposal					
Sediment Collection and Loading	30,000	CY	4.39	$131,700	Wheel loader
Waste Transportation	52,190	Ton	25	$1,304,750	
Waste Disposal	52,190	Ton	7	$365,330	Montana Waste Systems
Remove Stream Diversions	1	LS		$0	
Reclamation					
Grading and Contouring	9.4	Ac	2,000	$18,800	
Seed/Fertilize	9.4	Ac	2,000	$18,800	
Mulch	9.4	Ac	2,000	$18,800	
Subtotal				$7,235,106	
Design	6.3%			$455,812	
Construction Oversight	15%			$1,085,266	
Subtotal Capital Costs				$8,776,184	
Contingency	10%			$877,618	
TOTAL CAPITAL COSTS				$9,653,802	
POST CLOSURE MONITORING AND MAINTENANCE COSTS					
Monitoring	1	/Year	13,000	$13,000	
Subtotal				$13,000	
Contingency	10%			$1,300	
TOTAL ANNUAL O&M COST				$14,300	
TOTAL CAPITAL COSTS				$9,653,802	
PRESENT WORTH O&M COST	30	yrs @	7%	$177,449	
TOTAL PRESENT WORTH COST				$9,831,251	

Table 30. Comparative Analysis of Alternatives

Assessment Criteria	Alternative 1: No Action	Alternative 2A: Partial Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill
Overall Protection of Health and the Environment -		
Protection of Human Health	No reduction in risk.	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.
Environmental Protectiveness	No protection offered.	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.
Compliance with ARARs -		
Contaminant Specific	Would not be met.	Contaminant-specific ARARs are expected to be met in surface sediment. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.
Location Specific	None apply.	Location-specific ARARs would be met.
Action Specific	None apply.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence -		
Magnitude of Risk Reduction	No reduction in CoCs in any environmental media, except by natural degradation processes, which are not expected to be significant.	Moderately overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.
Adequacy and Reliability of Controls	No controls over any on-site contamination, no reliability.	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is questionable. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping.
Reduction of Toxicity, Mobility and Volume -		
Treatment Process Used and Materials Treated	None	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs
Reduction of Toxicity, Mobility and Volume -	No reduction in CoC toxicity, mobility or volume.	No volume actively treated; however, 5,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.
Expected Degree of Reduction	Minimal, via natural degradation and/or dilution only. Potential for future increases in mobility of contaminants as larger paint chips are broken down into smaller particles sizes.	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.
Short-Term Effectiveness -		
Protection of Community During Remedial Action	Not applicable.	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.
Protection of On-Site Workers During Removal Action	Not applicable.	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.
Environmental Impacts	Same as baseline conditions.	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. High potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required. Stream habitat and vegetation would be destroyed for several years.
Time Until Removal Action Objectives are Achieved	Not applicable.	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.
Implementability -		
Ability to Construct and Operate	No construction or operation involved.	Construction is easily implementable; water quality concerns make permitting difficult.
Ease of Implementing More Action If Necessary	Not applicable.	Additional dredging easily implementable if additional action determined necessary. Limited by sediment control.
Availability of Services and Capacities	Not applicable.	Available within state.
Availability of Equipment and Materials	Not applicable.	Available within state.
Estimated Total Present Worth Cost	**$177,449**	**$2,803,194**

Table 30. Comparative Analysis of Alternatives, continued

Assessment Criteria	Alternative 2B: Partial Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill	Alternative 3A: Partial Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredge with Disposal at a Solid Waste Landfill
Overall Protection of Health and the Environment -		
Protection of Human Health	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.
Environmental Protectiveness	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers and downstream sediment so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.
Compliance with ARARs -		
Contaminant Specific	Contaminant-specific ARARs are expected to be met in surface sediment over time with dispersion and dilution. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.	Contaminant-specific ARARs are expected to be met in surface sediment. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.
Location Specific	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action Specific	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence -		
Magnitude of Risk Reduction	Moderately to low overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.	Moderate overall risk reduction relative to PCBs expected. Low impact to streambed, streambank, and bank vegetation.
Adequacy and Reliability of Controls	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is questionable. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping. Downstream sediment left in place.	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is expected to be moderate to high in upper 6 inches. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping.
Reduction of Toxicity, Mobility and Volume -		
Treatment Process Used and Materials Treated	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs
Reduction of Toxicity, Mobility and Volume -	No volume actively treated; however, 2,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.	No volume actively treated; however, 5,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.
Expected Degree of Reduction	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.
Short-Term Effectiveness -		
Protection of Community During Remedial Action	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.
Protection of On-Site Workers During Removal Action	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.
Environmental Impacts	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. High potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required. Stream habitat and vegetation would be destroyed for several years.	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Moderate potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required.
Time Until Removal Action Objectives are Achieved	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.
Implementability -		
Ability to Construct and Operate	Construction is easily implementable; water quality concerns make permitting difficult.	Easily implementable.
Ease of Implementing More Action If Necessary	Additional dredging easily implementable if additional action determined necessary. Limited by sediment control.	Plain suction dredging easily implementable. Cutterhead needed to acquire additional depth capability
Availability of Services and Capacities	Available within state.	Available within state or nearby states.
Availability of Equipment and Materials	Available within state.	Available within state or nearby states.
Estimated Total Present Worth Cost	**$1,487,862**	**$2,839,575**

Table 30. Comparative Analysis of Alternatives, continued

Assessment Criteria	Alternative 3B: Partial Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredge with Disposal at a Solid Waste Landfill	Alternative 4A: Partial Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill
Overall Protection of Health and the Environment -		
Protection of Human Health	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Long-term maintenance and monitoring to provide continued protection of human health.
Environmental Protectiveness	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers and downstream sediment so exposure pathway is reduced but not eliminated. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.
Compliance with ARARs -		
Contaminant Specific	Contaminant-specific ARARs are expected to be met in surface sediment over time with dispersion and dilution. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.	Contaminant-specific ARARs are expected to be met in surface sediment. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.
Location Specific	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action Specific	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence -		
Magnitude of Risk Reduction	Moderate overall risk reduction relative to PCBs expected. Low impact to streambed, streambank, and bank vegetation	Moderately high to high overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.
Adequacy and Reliability of Controls	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is expected to be moderate to high in upper 6 inches of removal area. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping. Downstream sediment left in place.	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is expected to be high in upper 6 inches. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping.
Reduction of Toxicity, Mobility and Volume -		
Treatment Process Used and Materials Treated	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs
Reduction of Toxicity, Mobility and Volume -	No volume actively treated; however, 2,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.	No volume actively treated; however, 5,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.
Expected Degree of Reduction	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.
Short-Term Effectiveness -		
Protection of Community During Remedial Action	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.
Protection of On-Site Workers During Removal Action	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.
Environmental Impacts	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Moderate potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required.	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Temporary stream diversion required to facilitate dry excavation. Stream habitat and vegetation would be destroyed for several years.
Time Until Removal Action Objectives are Achieved	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.
Implementability -		
Ability to Construct and Operate	Easily implementable.	Easily implementable.
Ease of Implementing More Action If Necessary	Plain suction dredging easily implementable. Cutterhead needed to acquire additional depth capability	Additional dry excavation easily implementable if additional action determined necessary.
Availability of Services and Capacities	Available within state or nearby states.	Available within state.
Availability of Equipment and Materials	Available within state or nearby states.	Available within state.
Estimated Total Present Worth Cost	**$1,586,593**	**$2,650,698**

Table 30. Comparative Analysis of Alternatives, continued

Assessment Criteria	Alternative 4B: Partial Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill	Alternative 5: Complete Removal of PCB-Impacted Stream Sediment Via Mechanical Dredging with Disposal at a Solid Waste Landfill
Overall Protection of Health and the Environment -		
Protection of Human Health	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish; however, partial removal would leave PCBs in deeper sediment layers so exposure pathway is reduced but not eliminated. Long-term maintenance and monitoring to provide continued protection of human health.	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.
Environmental Protectiveness	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors; however, partial removal would leave PCBs in deeper sediment layers and downstream sediment so exposure pathway is reduced but not eliminated. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.
Compliance with ARARs -		
Contaminant Specific	Contaminant-specific ARARs are expected to be met in surface sediment over time with dispersion and dilution. Fish tissue PCB concentrations may not meet the TMDL target, but could achieve risk assessment target.	Contaminant-specific ARARs are expected to be met. Fish tissue PCB concentrations are expected to meet the TMDL target.
Location Specific	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action Specific	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence -		
Magnitude of Risk Reduction	Moderate overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.	Moderately high to high overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.
Adequacy and Reliability of Controls	Contaminated materials will be removed from surface sediment stream and isolated from human and environmental receptors. Removal effectiveness is expected to be high in upper 6 inches of removal area. Landfill permit requirements include long-term maintenance and monitoring for sediment that is disposed. PCBs in deeper sediment layers could be exposed in the future via scour or piping. Downstream sediment left in place.	Contaminated materials will be removed from stream and adequately isolated from human and environmental receptors; however, the degree of removal effectiveness is questionable. Landfill permit requirements include long-term maintenance and monitoring to provide continued long-term effectiveness and permanence of the remedy.
Reduction of Toxicity, Mobility and Volume -		
Treatment Process Used and Materials Treated	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs
Reduction of Toxicity, Mobility and Volume -	No volume actively treated; however, 2,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.	No volume actively treated; however, 30,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.
Expected Degree of Reduction	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.
Short-Term Effectiveness -		
Protection of Community During Remedial Action	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.
Protection of On-Site Workers During Removal Action	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.
Environmental Impacts	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Temporary stream diversion required to facilitate dry excavation. Stream habitat and vegetation would be destroyed for several years.	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. High potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required.
Time Until Removal Action Objectives are Achieved	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.
Implementability -		
Ability to Construct and Operate	Easily implementable.	Construction is easily implementable; water quality concerns make permitting difficult.
Ease of Implementing More Action If Necessary	Additional dry excavation easily implementable if additional action determined necessary.	Additional dredging easily implementable if additional action determined necessary. Limited by sediment control.
Availability of Services and Capacities	Available within state.	Available within state.
Availability of Equipment and Materials	Available within state.	Available within state.
Estimated Total Present Worth Cost	**$1,566,289**	**$12,192,561**

Table 30. Comparative Analysis of Alternatives, continued

Assessment Criteria	Alternative 6: Complete Removal of PCB-Impacted Stream Sediment Via Hydraulic Dredging with Disposal at a Solid Waste Landfill	Alternative 7: Complete Removal of PCB-Impacted Stream Sediment Via Dry Excavation with Disposal at a Solid Waste Landfill
Overall Protection of Health and the Environment -		
Protection of Human Health	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.	Encapsulation of PCB-laden sediment in a solid waste landfill is expected to reduce human exposure to PCBs in fish. Resuspension and redeposition of PCBs during dredging is a concern. Long-term maintenance and monitoring to provide continued protection of human health.
Environmental Protectiveness	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors. Resuspension and redeposition of PCBs during dredging is a concern for ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.	Encapsulation of contaminated materials in a solid waste landfill is expected to reduce overall ecological exposure to PCBs in ecological receptors. Landfill permit requirements include long-term maintenance and monitoring to provide continued environmental protectiveness.
Compliance with ARARs -		
Contaminant Specific	Contaminant-specific ARARs are expected to be met. Fish tissue PCB concentrations are expected to meet the TMDL target.	Contaminant-specific ARARs are expected to be met. Fish tissue PCB concentrations are expected to meet the TMDL target.
Location Specific	Location-specific ARARs would be met.	Location-specific ARARs would be met.
Action Specific	Action-specific ARARs would be met.	Action-specific ARARs would be met.
Long-Term Effectiveness and Permanence -		
Magnitude of Risk Reduction	Moderately high to high overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.	High overall risk reduction relative to PCBs expected. Potential for hydraulic instability induced by stream disturbance.
Adequacy and Reliability of Controls	Contaminated materials will be removed from stream and adequately isolated from human and environmental receptors. Removal effectiveness is expected to be moderate to high. Landfill permit requirements include long-term maintenance and monitoring to provide continued long-term effectiveness and permanence of the remedy.	Contaminated materials will be removed from stream and adequately isolated from human and environmental receptors. Removal effectiveness is expected to be high. Landfill permit requirements include long-term maintenance and monitoring to provide continued long-term effectiveness and permanence of the remedy.
Reduction of Toxicity, Mobility and Volume -		
Treatment Process Used and Materials Treated	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs	No treatment; however, removal and disposal of contaminated materials from the stream corridor is expected to provide reduction in mobility of PCBs
Reduction of Toxicity, Mobility and Volume -	No volume actively treated; however, 30,000 cubic yards of contaminated material would be removed and isolated in the repository.	No volume actively treated; however, 30,000 cubic yards of contaminated material would be removed and isolated in a permitted solid waste landfill.
Expected Degree of Reduction	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.	Volume or toxicity of wastes would not be reduced; however, mobility of PCBs would be reduced.
Short-Term Effectiveness -		
Protection of Community During Remedial Action	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.	Fugitive dust emission control may be required during construction. Impacts on the community include increased vehicle traffic on the route to the landfill. Noise impacts to local residents.
Protection of On-Site Workers During Removal Action	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.	Expected to be sufficient. Physical safety hazards likely more prevalent than hazards associated with wastes.
Environmental Impacts	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Moderate potential for resuspension and deposition of sediment during dredging. Sedimentation controls will be required.	Short-term environmental impacts possible due to location of contaminated material in Big Spring Creek. Temporary stream diversion required to facilitate dry excavation. Stream habitat and vegetation would be destroyed for several years.
Time Until Removal Action Objectives are Achieved	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.	Removal completed in one construction season. Degree of reduction of PCBs in fish tissue will not be known for 3 to 5 years until new generations of fish without exposure to PCBs are large enough to sample.
Implementability -		
Ability to Construct and Operate	Easily implementable. Liner installation will require intensive construction QA/QC.	Easily implementable.
Ease of Implementing More Action If Necessary	Additional dredging easily implementable if additional action determined necessary.	Additional dry excavation easily implementable if additional action determined necessary.
Availability of Services and Capacities	Available within state or nearby states.	Available within state.
Availability of Equipment and Materials	Available within state or nearby states.	Available within state.
Estimated Total Present Worth Cost	**$5,353,594**	**$9,831,251**